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INFLATION AND ECONOMIC DEVELOPMENT

AN EMPIRICAL STUDY

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Inflation and Economic Development: An Empirical Study" submitted by Edmund K. Mak in partial fulfilment of the requirements for the degree of Master of Arts.

ABSTRACT

Economists hold different views on the effects of inflation on economic development in the less developed countries. This thesis is to examine the effects of inflation on two components of development in these countries: the consumption and the investment demand.

A consumption function and an investment function are estimated using cross-section and time series data for a number of less developed countries. It is found that there are few uniform characteristics for countries with similar inflation experience. For countries with high rates of inflation, their rates of savings increase faster than other countries and inflation tends to create forced savings. For countries with moderate and high rates of inflation, price increases tend to exert positive influence on investment demand. However, the impact of inflation in most cases is insignificant, and it is doubtful if inflationary policy can effectively stimulate or retard economic activities in the less developed nations.

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Chapter 1

INTRODUCTION

There are two divergent views among economists regarding inflation and growth in under-developed countries.[1] Some regard inflation as inhibitive to economic growth and to the efficient allocation of resources. Others find merits in inflation as an instrument of growth and they recommend the deliberate use of inflationary policies to promote economic development. In this study, some of the propositions put forth by these two groups of economists will be tested. We shall summarize briefly the two positions.

The first group of economists argue that inflation diminishes the available real resources which are already scarce in less developed countries. In their view, this decrease in turn reduces the resources available for

[1]See for example, Rattan J. Bhatia, "Inflation, Deflation, and Economic Development", Staff Papers vol. 8 (November 1960), pp. 101-14; Roberto de Oliveira Campos, "Inflation and Balanced Growth", in H. S. Ellis ed., Economic Development for Latin America (London: McMillain & Co. Ltd., 1961), pp. 82-109; Harry G. Johnson, "Is Inflation the Inevitable Price of Rapid Development or a Retarding Factor in Economic Growth?", Malayan Economic Review, vol. 9 (April, 1966), pp. 21-8; Nicholas Kaldor, "Economic Growth and the Problem of Inflation", Economica vol. 25-26 (1959), pp. 212-26 and 287-98.

domestic investment through a reduction of national savings. As inflation continues, with relative stability of prices in foreign countries, it becomes more attractive to invest abroad and an outflow of savings would be encouraged. Not only is the quantity of the real resources reduced, the use of such resources tend to become less efficient. They contend that businessmen would maximize their profits--or minimize their losses--during inflation by investing in uses that bring high and quick return: inventory investment and real estate. While their private return may be highest of all the available investment opportunities, these uses have lower social return in that they do not improve the productive capacity of the economy. In this way, the allocation of resources is distorted and the pace of economic development retarded.

The second group of economists believe that resources available for investment does not necessarily decrease. Higher profitability due to inflation induces more savings into investment and encourage businessmen to improve the productive efficiency. They argue that businessmen prefer long term profits and would invest in activities that bring slower but higher return in the long run. Manufacturing industries which are often cited as the example, would enhance the long term productive capacity of the economy. Through this, inflation helps to induce the efficient

allocation of resources and to promote economic growth. They support the argument that mild rate of inflation is a necessary catalyst for economic growth in the less developed countries. There is no unanimity in defining the acceptable range of mild inflation, but 10% is generally regarded as the maximum ceiling.[1]

Most of the empirical work done to support both views are studies on the correlation between the rate of inflation and the rate of growth. Some of them fail to come up with positive conclusions.[2] Other studies turn up more definitive results by a better proportioning of countries with different inflation experience. The results, however, differ for different studies. Studying individual countries in different periods when different rates of inflation prevail, U Tun Wai finds no conclusive results between inflation and growth. However, there is some evidence to suggest that per capita

[1]Joseph O. Adekunle, "Rates of Inflation and Industrial, Others Developed and Less Developed Countries, 1949-65",: Staff Papers, (Nov. 1968), pp. 531-59; Annold C. Harberger, "Some Notes on Inflation" in Werner Baer and Issac Kerstenetzky (eds.), Inflation and Growth in Latin America, (Illinois: 1964), pp. 319-51; Harry G. Johnson, "Is Inflation the Inevitable Price of Rapid Development or a Retarding Factor in Economic Growth?", Malayan Economic Review, (Apr. 1966), pp.21-28

[2]Rattan J. Bhatia, "Inflation, Deflation and Economic Development," Staff Papers, Vol. 8 (Nov. 1960) pp.101-14

output tends to decrease in periods of mild to strong inflation.[1]

In another study covering different period, Dorrance finds positive relationship between mild inflation and the rate of growth, but the results are not strong enough to establish a definite conclusion.[2] More recently, it has been observed that regressing inflation with income, a positive relationship emerges.[3] Unfortunately, the significance of this relationship is not known as the standard error is not given. Besides, the developed countries are also included, thus diminishing the explanatory value for underdeveloped countries.

There are two defects in the approach cited in the above work to determine the effect of inflation on development. The first concerns the elements of growth. Can economic development be defined only in terms of output, particularly in underdeveloped countries where growth of output or the lack of it, does not necessarily reflect the presence or absence of economic development? One should further examine the effect of inflation on the

[1]U Tun Wai, "The Relation Between Inflation and Economic Development: A Statistical Inductive Study", Staff Papers, Vol. 7 (1959-60), pp. 302-17

[2]Graeme S. Dorraine, "The Effect of Inflation on Economic Development," in Werner Baer and Issac Kerstenetzky (eds.), op. cit., pp.37-88

A.P. Thirlwall and C. A. Barton, "Inflation and Growth: The International Evidence," Banca Nazionale del Lavoro, Vol. 24, (1971), pp. 263-75

various elements that make up the whole process of development. Shaalan follows this line of argument by examining the relative efficiency of capital use of undeveloped countries over time.[1] By studying the marginal capital output ratio and the price movement of selected countries, he concludes that inflation may have adverse effect on the economy's efficiency for countries with high rates of inflation. However, the marginal capital-output ratio can be affected by changes of factor prices, particularly wages, and other economic variables. This method thus fails to reveal the precise effect of inflation.

The second defect is the methodology itself. The correlation approach or the simple regression method adopted by most work has the limitation that the effect of inflation can not be precisely isolated. In actuality, one has to consider all the major factors before one can conclude if such factors significantly affect growth positively or negatively.

Literature on this subject in the 1960's has tried to avoid these two defects. Factors important to growth, particularly investment, are studied separately in relation to inflation. Multiple regression analysis is also employed so as to accomodate other factors of

[1] A. S. Shaalan, "The Impact of Inflation on the Composition of Private Domestic Investment:, Staff Papers, Vol. 9, (July, 1962)

influence besides inflation. Two works will be cited to illustrate.

In a study[1] Odeh formulates the consumption and investment functions for Brazil and Chile. Inflation is considered along with other economic variables as their determinants. The results of the estimation show that while inflation has no significant influence on consumption, it has positive effect on investment in Brazil but negative effect in Chile. This result does not help to resolve the question of inflation and growth since opposite findings obtained for countries which had high rates of inflation for the period under study.

A more recent work appraising the inflationary policies in Korea[2] show favorable results for such policy. Investment and its efficient use seem to be encouraged by the presence of sustained high inflation. To come to this conclusion, multiple regression method is used in most cases. However, Shaalan's method is employed when examining if investment is efficiently used. As mentioned, this method has its shortcomings and thus the conclusion of efficient use may not be entirely accurate.

[1]H. S. Odeh, The Impact of Inflation on the Level of Economic Activity, (Rotterdam, Netherlands: Rotterdam University Press, 1964)

[2]Youngil Lim, "Inflation and Capital Formation: Post War Korea," Economia Internazionale XXIII 1970

Purpose of The Study

It is felt that before one concludes on the effect of inflation on growth, it is imperative that the effect of inflation on the determinants of growth is fully investigated and understood. The present study will investigate the relationship between inflation and the two important determinants of economic development: consumption and investment. The question of efficient use of investment lies in the relation of inflation and investment in sectors that render higher social return. Attention would then be focused on fixed investment. This removes the effect on inventory investment which is regarded to bring least social return. We shall also examine indirectly the role of inflation on savings by observing its effect on consumption.

When the question of inflation and growth in less developed countries was dealt with in the past, attention was often focussed on a few countries which invariably have high rates of inflation. This study will cover countries with wide range of inflationary experience in order to formulate some general hypotheses based on the observations. Multiple regression analysis will be used to draw out the effect of inflation relative to other factors.

The Scheme

The Introduction will serve as Chapter 1. In Chapter 2, we shall consider the determinants of consumption in the less developed countries. An investment function would be developed in Chapter 3. This is followed by the description and definition of the data used in Chapter 4. The results of the finding for the consumption and investment functions will be presented and discussed in Chapters 5 and 6 respectively. Finally we shall summarize our conclusions in Chapter 7.

Chapter 2

CONSUMPTION DEMAND

In this chapter, we shall consider the major determinants of the consumption function. Hypotheses of the expected relationship of consumption with these ingredients would be specified, in particular, with inflation.

The Determinants of Consumption Demand

Of the economic variables, some of the more important in consumption studies are: the level of income and wealth, liquid assets, rate of interest, prices, family size. In the underdeveloped countries, however, some of these variables figure more prominently.

The income variable is often found to be significant in consumption behaviour. This is perhaps particularly true in less developed countries. We shall assume that the marginal propensity to consume is less than unity, implying the increase in income would induce a less than proportionate increase in consumption expenditure. The magnitude of the propensity differs between countries,[1] although it is generally believed

[1]See for example H. S. Odeh, op. cit., pp.57 and 62

that poorer countries with lower standards of living would have the marginal propensity closer to unity than other countries as they have to spend most of what they have in order to stay on subsistence level.

Income distribution can also have significant effects on the level consumption expenditure. High income groups are recognized to have lower marginal propensity to consume, as for every increment of income, they can afford a larger increment of savings than the low-income groups. If inflation does shift the proportion of income in favour of the high income groups, it follows that total consumption would decrease over time. If this effect is strong enough, there may even be a decrease in consumption even though total income may have increased. In the present context, the effect of income distribution is hard to observe as there is generally a lack of data.

The second economic factor to be considered is often called the real balance effect. When the stock of real cash balances is increased so is its purchasing power. This increase induces the consumers to spend more. During inflation, if the money supply with the public increases at a rate less than that of price, it is likely that consumption would be negatively affected. For this to happen, an additional assumption has to be made here, that there is no money illusion.

Presumabley, there may be a time lag in which the stock of real cash balances is not realized, but this lag can be quite small. It has yet to be tested if the real balance effect is a significant determinant of consumption expenditures in less developed countries.

We shall also examine the role of inflation. Inasmuch as rising prices create forced savings, we can expect a negative relationship between consumption and inflation. However, it is also possible that consumers in anticipating higher prices later, would spend more now as the level of current prices is lower than the expected level. A positive relationship between price and consumption can also occur when income has increased and the demand thus created raises consumption and prices simultaneously. It is likely that different countries may have different experiences and thus different net effect of inflation. It is the object of this study to find out the effect of inflation: if the countries with similar inflation experience have homogeneous relationship between price and consumption.

Other economic factors often deemed to be significant may be of secondary importance in less developed countries. The rate of interest is likely to have fairly small effect in these countries where

the financial institutions are not developed.[1] It will not be considered for this reason. The size of family may be relatively more important. But again, the lack of data has made it impossible for this variable to be included for consideration.

Beside the economic variables, there are other less tangible factors. The culture, political institution, tastes and preferences would all play a part in deciding the level and pattern of consumption. Their effect would make up the autonomous part of the expenditures.

The Consumption Function

In considering the function to be estimated, further assumptions have to be made. In the usual absolute income hypothesis of consumption, it is often assumed that the marginal propensity to consume is constant for all levels of income. This may not necessarily be true in the less developed countries. We shall allow that the marginal propensity to change with the level of income. This is a more realistic

[1]Two recent studies on savings give similar results. See J. G. Williamson, "Personal Saving in Developing Nations: An Intertemporal Cross-Section from Asia," Economic Record, Vol.44 (June, 1968), pp. 194-210; K. L. Gupta, "On Some Determinants of Rural and Urban Household Saving Behaviour," Economic Record, Vol. 46 (December 1970), pp. 578-83

assumption for at different levels of income, people may assume different consumption behavior. This assumption does not contradict the possibility that over a period the marginal propensity may remain constant, but we consider a difference in propensities with different levels of income more likely. In this connection, we also assume that the marginal propensities to consume with respect to real money supply and inflation can change with different levels of money supply and inflation.

Another assumption we make is that tastes and preferences do not necessarily remain constant. We assume that they can change with time.

For expository purposes, we shall derive the functional form by first assuming that real consumption is a function of real income and other autonomous factors only. The consumption function will be:

$$C_t = e^{at} Y_t^b \qquad (2.1)$$

Where C= real consumption
t= time
Y= real income
a,b= constant

If a is positive, then changes in tastes and preferences encourage consumption. If b, the constant income elasticity, is greater than unity, it means that consumption would increase at a rate faster than that of income, implying a decline in the rate of saving. On the other hand, if b is less than unity, consumption would only increase at a rate less than that of income

and the rate of saving would be increasing.

There is a third possibility: consumption may have unit elasticity; it then has the same rate of increase as that of income.

On a piori ground, we do not consider the case when b is negative, as we postulate that consumption and income have a positive relationship.

For the purpose of estimation, this function is turned into the linear form. Taking the logarithm of (2.1), we have

$$(2.2) \qquad \ln C_t = at + b \ln Y_t$$

Differentiating with respect to time t,

$$(2.3) \qquad \ddot{C}_t = a + b\ddot{Y}_t \qquad \text{Where } \ddot{C}_t = \frac{\dot{C}}{C}$$

$$\ddot{Y}_t = \frac{\dot{Y}}{Y}$$

We notice that a and b, the coefficients to be estimated remain unchanged.

The effect of real money supply and price can be incorporated in the original consumption function.

$$(2.4) \quad C_t = e^{at} Y_t^b M_t^c P_t^k \qquad \text{Where } M = \text{real money supply}, \; P = \text{price level}$$

For c and k greater than, less than or equal to unity, interpretation is similar to that of the coefficient of Y. Again, we postulate that consumption and real stock of money have a positive relationship and would reject any value of c less than zero. However, we shall allow k to be less than zero, in which case consumption and

price will have a negative relationship.

Following the same procedure as in (2.3) we have

$$(2.5) \qquad \ddot{C}_t = a + b\ddot{Y}_t + c\ddot{M}_t + k\ddot{P}_t \qquad \text{Where } \ddot{M}_t = \frac{\dot{M}}{M}, \quad \ddot{P}_t = \frac{\dot{P}}{P}$$

and c and k can be termed as the money and price elasticities respectively. This is the consumption function we are going to estimate. At this point, we shall look at the relationship of this function with a form of the absolute income hypothesis.[1] For simplicity, only equation (2.1) will be used.

Suppose per capita consumption is a linear function of per capita income, then

$$(2.6) \qquad \frac{C}{N} = a' + b'\frac{Y}{N} \qquad \text{Where N = population}$$

Multiplying both sides by N, we get

$$(2.7) \qquad C = a'N + b'Y$$

Differentiating the equation with respect to time.

$$(2.8) \qquad \dot{C} = a'\dot{N} + b'\dot{Y}$$

Divide the equation by C and with same adjustments, we have

$$(2.9) \qquad \ddot{C} = a'\frac{N\ddot{N}}{C} + b'\frac{Y\ddot{Y}}{C} \qquad \text{Where } \ddot{N} = \frac{\dot{N}}{N}$$

We notice that $b'\frac{Y}{C}$ is the income elastictity. $\frac{N}{N}$ is the rate of population change. So, for a particular point in time, (2.9) is of similar form as (2.3). The present formulation can be looked uponas a variant of the absolute income hypothesis.

[1]This was suggested in Odeh, op.cit. A somewhat similar formulation was used in his work.

Chapter 3

INVESTMENT DEMAND

Introduction

Investment is considered an important factor in the process of economic development. It has been identified as one of the most important sources of growth in the less developed countries.[1] At present, there are two general approaches to explain the theory of investment. One is the neo-classical approach, using the optimization procedure. There is some evidence that the neo-classical theory may be more superior.[2] However, for our purpose, it is not applicable because the kind of data often required are less easily obtainable in the less developed countries.

The other approach is the business cycle theory. Among other things, however, this theory is too restrictive in its assumptions. It implies that there is an equilibrium capital-output ratio in the economy. From the standpoint of the less developed countries, this

[1]Sherman Robinson, "Sources of Growth in Less Developed Countries," Quarterly Journal of Economics, Vol. 85 (1971),pp. 391-408

[2]Dale W. Jorgenson and Calvin D. Siebert, "A Comparison of Alternative Theories of Corporate Investment Behavior," American Economic Review,Vol 58 (1968), pp. 681-712

is not realistic. This point will be discussed later. We shall first briefly summarise the theory of investment in the business cycle approach and then develop our own investment model based on some modifications.

Investment Demand in Business Cycle Theory[1]

The Acceleration Principle is the simplest version of the trade cycle theory. It defines investment as the amount entrepreneurs add to the capital stock in order to accumulate the total capital stock to the desired level. It can be written as:

$$(3.1) \qquad II_t = K^{\#}_t - K_t$$

Where II_t = induced investment at time t,

$K^{\#}_t$ = desired capital stock at time t,

and K_t = actual capital stock at time t.

It postulates that there is a required stock of capital for every level of output in the economy. In other words, there is a certain ratio between output and the desired capital stock. Representing output in period t by X_t, we can write

$$(3.2) \qquad K^{\#}_t = vX_t$$

[1]R. M. Goodwin, "Secular and Cyclical Aspects of the Multiplier and the Accelerator," in Income, Employment and Public Policy (Essays in Honor of Alvin H. Hansen), (New York, W. W. Norton & Co., Inc., 1948) pp. 108-32; H. B. Chenery, "Overcapacity and the Acceleration Principle," Econometrica, Vol. 20, (January, 1952), pp. 1-28; R.C.O. Matthews, The Business Cycle, (New York, Cambridge University Press, 1967), Chapters II and III

v is often termed the capital output ratio. Rewriting (3.1) with one period lag, we get

$$II_{t-1} = K^{\#}_{t-1} - K_{t-1} \qquad (3.3)$$

subtracting (3.3) from (3.1), investment becomes the difference between the capital stock of the present and the previous periods,

$$II_t - II_{t-1} = K^{\#}_t - K^{\#}_{t-1} - (K_t - K_{t-1}) \qquad (3.4)$$

Since $II_{t-1} = K_t - K_{t-1}$, it follows that

$$II_t = K^{\#}_t - K^{\#}_{t-1} \qquad (3.5)$$

Substituting (3.2) in (3.5), we obtain

$$II_t = v(X_t - X_{t-1}) \qquad (3.6)$$

Induced investment is then proportional to the rate of change of output.

The rationale behind the capital-output ratio is based on two premises. The first concerns the physical relationship or the prevailing technology of the economy. At a certain point in time, the state of technique and the prices of the factors of production require a stock of capital to satisfy the level of demand. As the demand changes, the stock of capital would be adjusted accordingly. One of the implications of this assumption is that capital stock can be changed both ways; and entrepreneurs would disinvest in the same rate as they would invest. This is not too likely in the actual world. Instead, entrepreneurs would disinvest by not replacing the obsolete equipment and probably at a slower rate

than they would expand their plants, depending on the depreciation rate.

The second premise is based on the entrepreneurs' profit motive behind investment. Before he decides on the plant size and the equipment needed, the entrepreneur would calculate if the expected profit in the future justifies the capital stock he needs. He would project past profit into the future and previous demand is used as guide to indicate how much profit he may expect. Thus desired capital stock is a function of demand. Another arugment to support this motive is that profit is often used to finance the expansion of plants, as it is more preferred to borrowing from the capital market, particular when credit is tight. As profit depends on the level of demand, it follows that the desired capital is also a function of demand. It may be mentioned that based on this profit motive, an alternative function is developed showing investment positively related to the level of profit and negatively related to the capital stock of the previous period.[1]

The general case of the Acceleration Principle is called the capital adjustment principle or the flexible accelerator principle. The original assumptions, including that of the equilibrium capital-output ratio, are retained. The definition of investment is, however,

[1] L. R. Klein, Ecomonic Fluctuations in the United States, 1921-1941, (New York, 1950)

somewhat different. Entrepreneurs would still adapt the capital stock to the desired level through investment, but with time lag. In this formulation, investment demand is represented by

$$(3.7) \qquad II_t = u\,(K^{\#}_t - K_t)$$

The response coefficient u represents the speed at which the actual capital is adjusted to the desired stock. When u is less than or equal to unity, it implies that there would be a delay in the process of adjustment, or an adaptation completed in the same period respectively. By assuming a constant capital-output ratio, the investment function can be derived in the same way as the Acceleration Principle in terms of output. Accordingly

$$(3.8) \qquad II_t = u(vX_t - K_t)$$

The generalized version, however, does not improve much on the shortcomings of the Acceleration Principle. In particular, the capital-output ratio is still maintained. This is unrealistic specially for the underdeveloped countries, as it allows no other economic variables to be considered in determining the desired capital stock. In the next section, we shall propose a modified hypothesis of investment demand for the less

developed countries, by redefining the desired capital stock.[1]

The Desired Capital Stock

We shall define induced investment demand as in the Acceleration Principle. Thus

$$(3.1) \qquad II_t = K^{\#}_t - K_t$$

As before, investment can be expressed as the difference between the desired capital stock of two successive periods. Recall

$$(3.5) \qquad II_t = K^{\#}_t - K^{\#}_{t-1}$$

We shall now redefine the desired capital stock in the light of the less developed countries.

Before committing themselves, the entrepreneurs would, as postulated in the Acceleration Principle, look upon the level of demand as an indicator of how much they should expand their plants, if at all. The higher the level of demand, the bigger market it indicates and the more capital they need for the production to meet the demand. It can be expected that the desired capital stock varies positively with demand. In the less developed countries especially, the entrepreneurs would rely on demand of previous period as indicator of present demand. We shall postulate that the desired

[1]A similar version of the definition we are going to propose is adopted by Hiroki Tsurumi, "Effects of Wage-Parity and Price Syneronization Between Canada and The United States on Canadian Economic Growth: Simulation Experiments with a Macro Model," (Institute of Economic Research, Queens University, April, 1971)

capital stock is positively related to the output or demand of the previous period.

Beside market, the entrepreneurs would also consider the availability of credit. It is likely that profits are not enough to finance the increase of capital, and external funds have to be sought for. Under this circumstance, the financial variables would figure prominently. This is perhaps particularly true in the less developed countries in which industrial development is in relatively infant stage with smaller profit and would rely more heavily on credit funding than that in the developed countries. The financial variables would include money supply and the rate of interest. The latter would reflect the cost of capital. The expected return on the desired stock of capital has to be greater than or at least equal to the rate of interest before it is worthwhile to borrow funds to expand the capital stock. One would expect an inverse relationship between the desired capital stock and the interest rate. On the other hand, with more money supply in the economy, there would be greater availability of funds for investment. Therefore one would expect a positive relationship between money supply and the desired stock of capital.

Changes in money supply and rate of interest may influence investment decisions with a lag. This possibility will be examined in the empirical estimates.

The financial variables are often influenced by

the government directly or indirectly. An abundant supply of money and a low rate of interest would be indicators to the entrepreneurs that the government is encouraging production and they would feel secure to expand the capital stock to the desired level. Conversely, a shrinking money supply and high interest rate would cause the entrepreneurs to be more reluctant to obtain a large stock of capital to run into liquidity risk, or they would even diminish their stock in view of the discouragement from government. This factor strengthens the positive and the negative effects of money supply and the interest rate, respectively.

A third factor we consider is the effect of price. It is not as clear as the other two. As mentioned, there is some disagreement among economists about the exact effect of price. When the price is relatively high, some entrepreneurs may regard this as opportunity for relatively high profit and would incline to desire larger stock of capital. Others may see this as a deterrent to prevent demand to increase as much as it would have, as they believe consumers would be discouraged to increase spending; they also see high prices as a disruptive agent shaking the general confidence of the economy. With such consideration, they would not plan for a large capital stock or may even decrease it. The desired capital stock and the price level are positively related according to the first view, but negatively

related according to the second.

Inflation or the rate of price change may also be significant in the entrepreneur's decision. Here again, there can be two interpretations for the entrepreneurs. A large positive change may encourage some but may discourage others to raise their stock of capital. A small increase or a deflation may be considered as not enough incentive while it may please others who regard price stability a great asset for planning their future business.

The difference in interpretation lies in how the entrepreneurs project the past into the future. If they project positively, high prices and/or inflation would be signal for the need of a large stock of capital. Conversely, if they project negatively, high prices and/or inflation may discourage the accumulation of capital stock. It is possible that high prices and high inflation have opposite effects. So would low prices and low inflation. Whatever their effects, it is our hypothesis that countries with the same inflation experience would have similar price and inflation effects on their desired capital stock.

We shall assume that real output, real money supply, interest rate, price and inflation--all lagged one period--are linearly related to the desired real capital stock. Lagging of one period is necessary as we

assume the past influences the future decision to the entrepreneurs. Accordingly

$$(3.9) \quad K^{\#}_t = h_2 X_{t-1} + h_3 M_{t-1} + h_4 r_{t-1} + h_5 P_{t-1} + h_6 \ddot{P}_{t-1}$$

Where X_{t-1} = real output at time t-1

M_{t-1} = real money supply at time t-1

r_{t-1} = interest rate at time t-1

P_{t-1} = price at time t-1

$\ddot{P}_{t-1}$ = inflation or relative price change at time t-1

The Investment Function

We are now in a position to develop the investment function for estimation. Lagging (3.9) by one period, subtracting it from (3.9) and substituting the difference in (3.5), we get

$$(3.10) \quad I\ddot{I}_t = h_2 \Delta X_{t-1} + h_3 \Delta M_{t-1} + h_4 \Delta r_{t-1} + h_5 \Delta P_{t-1} + h_6 \Delta \ddot{P}_{t-1}$$

P_{t-1} represents inflation of previous period and P_{t-1} is the rate of price change at time t-1.

From the discussion above, we hypothesis that

$$h_2 > 0$$

$$h_3 > 0$$

$$h_4 < 0$$

while h_5 and h_6 are to be tested. Positive values of h_5 and h_6 would indicate that inflation and the rate of inflation are incentives to induce investment. On the other hand, negative values of h_5 and h_6 imply that inflation and the rate of inflation or price expectation

discourage the increase of investment.

We recall that II is the amount of induced investment. In the less developed countries, where government development policy, political stability and foreign influence may play a major role in determining the overall total investment, these factors would likely add an autonomous amount to the induced investment. Representing autonomous investment by h_1, the total investment is

$$(3.11)\quad I_t = h_1 + h_2\Delta X_{t-1} + h_3\Delta M_{t-1} + h_4\Delta r_{t-1} + h_5\Delta P_{t-1} + h_6\Delta\ddot{P}_{t-1}$$

This is the investment function that will be estimated for the time series study.

Some modification is required for the cross-section. The variables in absolute terms have to be adjusted for the difference of population between countries. Investment, the change of output and the change in money supply are divided by the gross domestic product of the corresponding year. The adjusted investment function thus becomes

$$(3.12)\quad \left(\frac{I}{X}\right)_t = h_1' + h_2'\left(\frac{\Delta X}{X}\right)_{t-1} + h_3'\left(\frac{\Delta M}{X}\right)_{t-1} + h_4'\Delta r_{t-1} + h_5'\Delta P_{t-1} + h_6'\Delta\ddot{P}_{t-1}$$

Chapter 4

THE DATA

The hypotheses set up in Chapters 2 and 3 will be examined from two angles: the cross-section and the time series studies. The former is designed to show the phenomenon for a large number of countries at a point in time. The latter is to reveal the pattern of consumption and investment for the selected countries over a period of time.

The cross-section study has the advantage of being able to reveal the characteristics common to the countries studied for a moment in time. The time series approach, on the other hand is a study of the trend of development over a period of time. It is best suited for describing the tendency of a particular country. Unless this approach is used for the analysis of a number of countries, one may not conclude from the results of a particular country that they are true for others without risking over-generalization. If similar results are obtained for both the time series and the cross-section approach, we have evidence that there are uniform characteristics for the countries studied.

The Cross-Section Study

A total of thirty-four countries are chosen for the consumption study and thirty-seven for the investment function estimation. There are two criteria for the choice. First, the countries must be "under-developed". One may define underdevelopment in at least two ways, according to per capita income and according to the state of technology.[1] We shall adopt the latter definition which is also the classification used in the United Nations' Statistical Yearbook. Countries that fit this category are those in Africa, except South Africa whose dual economies make interpretation of statistics difficult, Latin America and Asia, except Japan which is no longer classified as an underdeveloped country.

The second criterion is the availability of data. The countries selected must have data on all the variables included in our study. The principal sources of data are the United Nations publications: the Statistical Yearbook and the Yearbook of National Accounts Statistics, and the monthly International Financial Statistics of the International Monetary Fund. To estimate C_t, Y_t, M_t, P_t, the consumption, national income, money supply and consumer price index, with 1963 as the base year are used. Private consumption is the total

[1]Everett E. Hagen, The Economics of Development (Illinois: Richard D. Irwin, 1968), pp. 5-7

consumption expenditure incurred by the private sector.

Disposable income is not used as data on income tax are very sketchy. Money supply includes the currency in circulation and demand deposits. The consumer price index or the cost of living index may not be the best indicator of inflation in all cases. However, the most complete data available for most countries are for this index only. 1963 is the base year for the price index as the available data are given with 1963 as the base year. Real values are used in the estimation and they are obtained by deflating the nominal values of C_t, Y_t, and M_t by the price index.

For the investment function, annual data of total fixed capital formation, gross domestic product, money supply and consumer price index with 1963 as the base year are used for I_t, X_t, M_t and P_t. As mentioned in Chapter 1, by leaving out the investment in inventories, more light can be shed on the effect of economic variables on the efficient use of investment. So total fixed capital formation is used. In any case, data on investment in inventories for many countries are not reported for every year. Money supply and the price index have the same definitions as in the consumption function. Again, real values are used by deflating the nominal values by the price index. The interest rate is not considered because very little data on this variable are available.

1965 is the year chosen for the study. Three more years of data are needed for estimation and 1965 with three years previous to it have the most reliable and available data for the largest number of countries.

In Chapter 1, it was mentioned that there was no agreement as to the dividing line between low and moderate and between moderate and high inflation. In any case, whatever classification one adopts, it is bound to be somewhat arbitrary and in the empirical works cited, this appears to be the case as no reasons were given for the classification used. Therefore, for our study, we shall adopt the classification used by Thirlwall and Barton.[1] This study shows relatively more conclusive evidence on the effect of inflation on economic growth than other studies on the same subject. So the three categories of countries are classified as low inflation countries with less than 3%, moderate inflation countries with 3% to less than 10% and high inflation countries with 10% or higher.

The countries with available data are classified into these three groups. The rates of inflation are obtained by taking an average of the three years, the time period covered by the cross-section analysis. Table 1 shows the countries studied and their average rates of inflation. The latter show three distinct categories which fit in the classification adopted.

[1]A. P. Thirlwall and C. A. Barton, op. cit. p. 271

Table 1

Average Rates of Inflation of the Countries Studied for 1962-1965

Countries	Rates of Inflation	Countries	Rates of Inflation
Low Inflation Countries		Moderate Inflation Countries	
Ceylon	1.80	Bolivia	6.12
Costa Rica	0.97	Honduras	3.12
Dominican Republic	0.32	Israel	6.41
Ecuador	1.26	Ivory Coast	3.42
El Salvador	0.32	Libya	4.23
Guatemala	-0.02	Mexico	3.12
Guyana	1.61	Nicaragua[1]	3.41
Iran	1.91	Niger[1]	4.47
Jamaica	2.23	Nigeria[1]	4.48
Malaysia	0.33	Pakistan	5.36
Malta	1.29	Sierra Leone	6.36
Morocco	2.21	Tunisia[2]	4.54
Panama	1.30		
Paraguay	2.22	High Inflation Countries	
Taiwan	0.65		
Thailand	2.22	Argentina	21.49
Trinidad	2.22	Brazil	38.81
Veneznela	1.92	Chile	24.15
		Colombia	11.66
		Ghana[1]	12.52
		Korea	14.95
		Peru	10.78
		Philippine	11.09

[1]Not included in consumption function estimation due to lack of data.

[2]Not included in investment function estimation due to lack of data

Sources: Calculated from United Nations Statistical Yearbook and International Monetary Fund, International Financial Statistics

The Time Series Analysis

For the time series analysis, we shall select the countries which display different inflation experiences. For this purpose and to avoid ambiguities about classification, we select the countries which can be regarded as displaying maximum price stability, say below 1%.[1] In the moderate inflation group, we select countries with rates of inflation between 5% and 7%. The reason for choosing this range is that in a number of studies 5% is accepted as the rate describing price stability,[2] and in other studies, 7% is the preferred maximum rate for describing moderate inflation level.[3] For the high inflation group, countries with around 10% inflation rate are chosen. The reason for this is that rates above this level have been found to be almost conclusively detrimental to economic growth.[4]

[1]Joseph O. Adekunle, op. cit.

[2]Graeme Dorrance, op. cit.

[3]Harry Johnson, op. cit.

[4]John P. Powelson, Latin America: Today's Economic and Social Revolution, (new York: McGraw-Hill Book Company, 1964), pp.165-93; see also A. P. Thirlwall and C. A. Barton, op. cit., and Graeme Dorrance, op. cit.

The actual number of countries in each group is further determined by the availability of data for at least ten years. The reason for this is statistical. For more reliable estimates, it is preferrable to have more than two degrees of freedom.[1] Thus, in the estimation of the parameters for the investment function, we need at least ten years for these estimates to be reliable.

The average rates of inflation are calculated for each country in Table 1 for the period for which the data are available. Those countries that have more than ten annual data for all the variables and whose average rates of inflation satisfy our criteria, are selected for the time series analysis. It turns out that there are two countries in each inflation group that satisfy our conditions.

1. Low Inflation Countries:

Guatemala	average rate of inflation	0.66%	1950-68
Panama	average rate of inflation	0.58%	1950-68

2. Moderate Inflation Countries:

Israel	average rate of inflation	6.35%	1952-68
Taiwan	average rate of inflation	6.67%	1951-68

3. High Inflation Countries:

Colombia	average rate of inflation	10.0%	1950-68
Korea	average rate of inflation	11.0%	1955-68

[1]This is suggested in Ronald J. Wonnacott and Thomas H. Wonnacott, Econometrics, (New York: John Wiley & Sons, Inc., 1969), pp. 52 and 364

Taiwan is no longer in the low inflation group, implying a slow rate of price increase in the early 1960's which is the period covered by the cross-section analysis.

Definitions of the data are the same as those for the cross-section study. For Taiwan and Korea, the availability of data allows the effect of interest rate to be studied.

The call money rate is the interest rate variable used. The call money rates are generally not as sensitive to the market conditions as, say, the government bond yield. However, only such rates are available for these countries and they do serve as an approximate indicator of the going rate of interest.

Chapter 5

RESULTS ON THE CONSUMPTION FUNCTION

The consumption function is estimated by the ordinary least squares method. Besides the model set up in Chapter 2, three alternative calculations are made for comparison with the complete model. In the first equation, only the income variable is considered. In the second equation inflation is included and in equation three, the money supply is included. The full model is presented in equation four. The standard errors of the coefficients are given in parenthesis beneath the coefficients. 90% will be the level of statistical significance used in the discussion.

A. Cross-Section Analysis

The estimated consumption function for the thirty-five countries surveyed is presented in Table 2. Also included are the functions estimated for the countries with different levels of inflation. The four equations in each case show the relative change in consumption as a linear function of the relative changes in national income, money supply and the price level.

Table 2

Cross-Section: Consumption Function

	Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1. Countries With Low Inflation	1.	-.0054 (.0059)	.8088 (.0791)			.8463
	2.	-.0056 (.0064)	.8086 (.0812)		.0215 (.1886)	.8464
	3.	.0027 (.0090)	.8102 (.0810)	-.0338 (.0835)		.8477
	4.	-.0021 (.0111)	.8106 (.0834)	-.0379 (.0980)	-.0196 (.2204)	.8477
2. Countries With Low and Moderate Inflation	1.	.0073 (.0056)	.5916 (.0667)			.7376
	2.	.0072 (.0063)	.5911 (.0692)		.0061 (.1568)	.7376
	3.	.0076 (.0060)	.5884 (.0699)	.0000016 (.000008)		.7379
	4.	.0075 (.0065)	.5872 (.0732)	.000002 (.0000085)	.0115 (.1621)	.7380
3. All Countries	1.	.0148 (.0055)	.4714 (.0694)			.5482
	2.	.0192 (.0067)	.4482 (.0720)		-.0527 (.0459)	.5637
	3.	.0154 (.0057)	.4658 (.0711)	.000005 (.000010)		.5510
	4.	.0202 (.0070)	.4402 (.0739)	.000006 (.00001)	-.0552 (.0466)	.5679

i. Low Inflation Countries

We shall first consider the countries with low inflation. The constant term is not statistically significant in any of the four equations. However, there is a tendency that it is negatively related to the change in consumption. This implies that consumption decreases as a result of change in taste and preferences, but this decrease is not of significant magnitude.

The income variable is significant in all cases. To induce a change in the level of consumption, the change in income remains a major factor. The coefficients for the income elasticity of consumption are quite stable and are approximately 0.81. For 1% increase in total income, about 0.81% increase in consumption in the private sector can be expected. According to our assumption in Chapter 2, we interpret this as when the marginal propensity to consume changes with income, it changes at a rate slower than the rate of change of income. This suggests that the rate of the marginal propensity to save would increase as income increases. In other words, people in the low inflation underdeveloped countries would tend to save more as their income increases. If these savings are channelled into domestic investment, the aggregate private investment would also increase.

In contrast, the money supply variable is not significant in the two equations considered. Moreover,

it appears to have a negative relationship with the consumption variable. For an increase in the real value of money, real consumption expenditure would decrease. This is contrary to what we postulate in Chapter 2 and the real balance effect works the opposite way. Similar results are reported for a study on Brazil.[1]

The effect of inflation is also not significant. Consumers in low inflation countries do not make appreciable change in consumption expenditures as a result of higher prices.

ii Moderate Inflation Countries

When countries of moderate inflation are included, there is a noticeable change in the coefficients. The constant term is still not statistically significant but the positive sign in all four equations suggests that consumption would tend to increase as a result of a change in the tastes and preferences. The difference in sign between this constant term and the previous one shows that moderate inflation countries have a stronger tendency for taste and preferences to affect consumption positively.

The income elasticity is significant everywhere. Its value is also quite stable around 0.59. This means that the income elasticity for the moderate

[1]H. S. Odeh, op. cit., p.51

inflation countries is less than 0.59. The magnitude of the elasticity is significantly lower than that of the low inflation countries. This can be attributed to the inclusion of the moderate inflation countries which, implied in this result, has lower income elasticity. From what we postulate, this means that the rate of change of consumption relative to that of income is lower in the moderate inflation countries, or the rate at which the marginal propensity to save increases with income is larger relative to the low inflation countries.

The effect of the relative change in money supply is very small and is not significant. However, the positive sign indicates that money may exert postive effect on consumption.

Inflation also has little effect as the coefficients are insignificant. The positive sign, however, suggests that consumers may have been encouraged by inflation; they may anticipate further price rise and increase current consumption at the expense of future expenditure.

iii <u>High Inflation Countries</u>

The third part of Table 2 shows the consumption relation of all countries. Again, there is a marked difference in coefficients with the other two parts. The difference is due to the inclusion of the high inflation countries.

The constant term is positive and significant. This shows that people in the high inflation countries tend to increase their consumption expenditure as a result of a change in habit or in social and other autonomous factors. This change accounts for about 1.5% to 2% change in consumption.

The income elasticity is significant but is lower than that of the other two previous ones. The implication is that in high inflation countries, savings would accumulate faster than that of the other two categories.

The supply of money has very insignificant effect, although the positive sign of the coefficients support the real balance effect. The high inflation and the moderate inflation countries are similar in their money elasticities, positive but insignificant.

Unlike the previous findings, the price elasticity is negative. Although it is insignificant, the smaller standard error makes it more significant relative to the elasticity of the first two categories. We may infer from this that in high inflation countries, inflation tends to have larger effect and would likely discourage consumption or create forced savings. If these savings are channelled into efficient use, inflation may eventually promote economic development.

To recapitulate, autonomous consumption tends to decrease over time for low inflation countries,

but it is only in the high inflation countries that the effect of autonomous change has impact on consumption. Income remains the major determinant of consumption. At higher level of inflation, the income elasticity tends to decrease or saving tends to increase faster. The effect of money supply is negligible. The price effect is also not significant. There is evidence to show that inflation may encourage consumption in moderate inflation countries but forced savings in high inflation countries.

There is one further point worth mentioning. The magnitude of the R^2 decreases every time another category of countries in included. It seems that the goodness of fit is better for individual categories when studied separately. This would seem to support the hypothesis that the countries with similar inflation experiences may have similar consumption behavior.

B. Time Series Analysis

The results of the time series analysis are presented in the same format as the results of the cross-section analysis.

i Low Inflation Countries
Guatemala

Referring to Table 3, we notice that the constant term is insignificant. However, in the complete model, it is greater than its standard error and is

Table 3

Guatemala: Consumption Function For 1950-68

Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1.	.0057 (.0080)	.8324 (.1741)			.5883
2.	.0048 (.0083)	.8254 (.1776)		.1834 (.2800)	.5997
3.	.0112 (.0070)	1.0080 (.1573)	-.1733 (.0607)		.7332
4.	.0117 (.0075)	1.0165 (.1661)	-.1794 (.0673)	-.0625 (.2535)	.7344

positive, indicating that autonomous consumption would increase over time. The income elasticity ranges between 0.82 and 1.02 in the four equations and it increases whenever money supply is introduced. The complete model suggests an income elasticity of close to unity implying that income and consumption increase at approximately the same rate. The money supply elasticity is negative and is significant. This contradicts the hypothesis that increases in money supply encourages consumption. The effect of inflation is not significantly different from zero, although its sign suggests a negative relationship with consumption.

Panama

The results in Table 4 show that the constant term is not significant but is positive throughout, implying that autonomous consumption tends to increase over time. The income elasticity is significant and remains the major explanatory variable of the consumption function. In our model the income elasticity is 0.73. The effect of money supply is insignificant but shows a negative relationship with consumption. Inflation also has little impact but seems to affect consumption positively.

A comparison of the results of the time series and cross-section analysis for countries in the low inflation group shows that apart from income, money supply, inflation and autonomous factors have little

Table 4

Panama: Consumption Function For 1950-68

Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1.	.0118 (.0129)	.6434 (.1920)			.4124
2.	.0073 (.0135)	.6633 (.1919)		.5803 (.5374)	.4548
3.	.0127 (.0129)	.7537 (.2224)	-.0970 (.0985)		.4481
4.	.0089 (.0140)	.7341 (.2273)	-.0665 (.1081)	.4418 (.5933)	.4691

effect on consumption expenditures. The estimates of the income elasticity for the two types are fairly close. The sign of the coefficient of money supply in both indicates a negative effect on consumption. The sign on the coefficient of the inflation variable is not uniform for the two countries studied in the time series analysis and therefore no clear cut comparison is possible between the results of the cross-section and the time series analysis.

ii Moderate Inflation Countries
Israel

From the results in Table 5, we notice that the constant term representing autonomous change is not significantly different from zero although the positive sign indicates rising consumption as tastes and preferences change. The income elasticity is significant. Its coefficient is quite stable in the four equations and is about 0.80. To induce an 8% increase in consumption, a 10% increase in income is necessary. The less-than-unity elasticity suggests that as income increases, consumption would increase but at a decreasing rate. Conversely, savings would increase at an increasing rate. The money supply elasticity is not significant although its sign is positive. The price elasticity not significantly different from zero. The negative sign, however, suggests that inflation may create forced savings.

Table 5

Isreal: Consumption Function For 1952-68

Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1.	.0090 (.0086)	.8024 (.0864)			.8605
2.	.0097 (.0120)	.7996 (.0951)		-.0069 (.0794)	.8606
3.	.0087 (.0093)	.8005 (.0919)	.0037 (.0390)		.8606
4.	.0092 (.0156)	.7995 (.0990)	.0026 (.0500)	-.0039 (.1017)	.8606

Taiwan

As shown in Table 6, the constant term is insignificant and negative. The income elasticity is significant and lies between 0.90 to near unity. In equation (4), it is 0.93 implying that the pace at which savings are accumulated would increase only slightly with the increase in income. Both the money supply and inflation have insignificant impact on consumption although their signs in the complete model suggest positive relationship.

The results of these two countries in the moderate inflation group show that income is the chief determinant of consumption and has an elasticity of over 0.80. Money supply, inflation and autonomous factors are insignificant. The sign of the money supply coefficient indicates a negative effect on consumption. The sign of the autonomous factors and inflation are not uniform for both countries. However, the positive relationship of inflation with consumption is more suggestive in the case of Taiwan as its coefficient is greater than its standard error.

Considering the results of the time series and the cross-section analysis, we find that income plays a central role in influencing consumption expenditures. Money supply, inflation and the autonomous factors have little impact although with some suggestive evidence to the contrary with regard to prices as in the case of

Table 6

Taiwan: Consumption Function For 1951-68

Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1.	.0038 (.0137)	.9020 (.1564)			.6753
2.	-.0128 (.0154)	.9416 (.1464)		.1927 (.1012)	.7385
3.	.0114 (.0152)	.9912 (.1740)	-.1093 (.0967)		.7008
4.	-.0152 (.0237)	.9302 (.1736)	.0174 (.1289)	.2061 (.1443)	.7388

Taiwan. There is no conclusive evidence as to in what direction money supply, prices and autonomous factors may affect consumption, owing to the difference in signs. This suggests that countries with similar inflation experience can have different consumption characteristics.

iii High Inflation Countries

Colombia

Referring to Table 7, the complete model shows that the constant term is positive and greater than its standard error indicating that autonomous consumption would increase over time. Income is the most important determinant of the consumption expenditures. Both the money supply and inflation coefficients are negative and greater than their standard errors suggesting that they may affect consumption adversely. The sign of the money supply variable is contrary to our a piori expectations. The adverse relationship between inflation and consumption indicates that inflation helps to create forced savings.

Korea

The results are shown in Table 8. In the complete model, the constant term is insignificant. Its positive sign suggests that autonomous consumption may increase over time. Income elasticity is significant and is about 0.59. With money supply, the elasticity is insignificant and its negative sign is contrary to our

Table 7

Colombia: Consumption Function For 1950-69

Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1.	.0135 (.0076)	.7346 (.1142)			.7210
2.	.0212 (.0198)	.6641 (.2028)		-.0559 (.1312)	.7243
3.	.0130 (.0077)	.8589 (.1713)	-.0831 (.0852)		.7376
4.	.0361 (.0218)	.7351 (.2023)	-.1420 (.0994)	-.1681 (.1492)	.7594

Table 8

Korea: Consumption Function For 1955-68

Equation	Constant Term	Regression Coefficients of $\ddot{Y}_t$	$\ddot{M}_t$	$\ddot{P}_t$	R^2
1.	.0269 (.0225)	.5797 (.2604)			.3106
2.	.0289 (.0281)	.5905 (.2846)		-.0262 (.1957)	.3118
3.	.0272 (.0268)	.5791 (.2740)	-.0018 (.0790)		.3106
4.	.0319 (.0399)	.5932 (.3008)	-.0110 (.0997)	-.0413 (.2473)	.3127

hypothesis. Although the effect of inflation is not significant, it tends to decrease consumption and create forced savings.

Comparing the results of Colombia and Korea, we find that the sign and statistical significance of the independent variables are similar in both cases. Income is an important determinant of consumption. In Korea, the elasticity seems to be lower implying that the rate savings may be faster. For the constant term, money supply and inflation, the coefficients for Colombia although not significant at the 90% level, are greater than their standard errors, thus indicating a somewhat more pronounced effect of these factors for Colombia.

The results of the high inflation countries provide the closest similarity for the cross-section and the time series analysis. Apart from the difference in sign in the money supply elasticity, other variables seem to have fairly similar effects. The evidence suggests that income elasticity is generally lower and savings increase at a faster rate in the high inflation countries. The effect of inflation, although not significant may affect consumption adversely and create forced savings. The combination of the income and the price effects means that these countries could achieve a desired level of savings faster than countries with relatively lower inflation. However, the insignificance

of the inflation implies that inflation tax policy may be ineffective in increasing the rate of saving.

C. Conclusion

The foregoing discussion on the consumption relation reveals that there is no uniform characteristics for all countries, even for those with similar rates of inflation. Exceptions are those with high rates of inflation. In these countries, we find evidence that the rate of savings increase may be relatively higher and inflation may tend to create forced savings. For the rest, however, one cannot say that inflation decreases or increases savings. The ability of a certain level of inflation or price stability to reduce or promote savings is not conclusively evident for all the countries studied. Inflation can have widely different results in different countries. For the countries surveyed, we find only token effects.

Chapter 6

RESULTS ON THE INVESTMENT FUNCTION

The investment function is estimated by the ordinary least squares method. For the purpose of comparison with the complete model set up in Chapter 3, five other calculations are made besides the full model. In the first equation, only output is the explanatory variable. In the second equation, the inflation variable is introduced and the third equation includes further the price expectation variable. Output and financial variables are the explanatory variables in equation four. The inflation and price expectation variables are further included in equations five and six respectively. Equation six is our complete model. The standard errors of the coefficients are given in parenthesis beneath the coefficients. The level of statistical significance used in the discussion will be 90%.

A. Cross-Section Analysis

The estimated investment functions for the thirty-seven countries are given in Tables 9, 10, 11 and 12. Each category of countries will be discussed individually.

i Low Inflation Countries

In Table 9, the constant term representing the ratio of autonomous investment to total output is significant. In the complete model, it is about 0.13. The average ratio of total fixed investment to output is 0.14 for the countries studied, indicating that a large proportion of total fixed investment is determined by autonomous factors. In contrast, the rate of change of output and the ratio of the change in money supply with respect to total output are insignificant. The change in demand and money supply in this case do not induce the entrepreneurs to invest in fixed capital. The reason is indicated by the relatively more important role of autonomous factors.

Inflation, represented by the change in prices of last period (ΔP_{t-1}), has insignificant effect. However, the positive sign suggests that inflation may be an incentive to induce fixed investment. The R^2 is considerably improved with the inclusion of the price expectation variable, ($\Delta \ddot{P}_{t-1}$).

The fact that the price expectation coefficient is significant and positive shows that the faster prices are rising, the more incentive there will be for the entrepreneurs to invest.

Table 9

Cross-Section: Gross Fixed Investment Function

	Equation	Constant Term	Regression Coefficients of $(\Delta X/X)_{t-1}$	$(\Delta M/X)_{t-1}$	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
Countries With Low Inflation	1.	.1281 (.0380)	.2083 (.4767)				.0135
	2.	.1276 (.0516)	.2100 (.5059)		.00023 (.0148)		.0135
	3.	.1132 (.0478)	.2337 (.4626)		.0135 (.0152)	1.833 (.9720)	.2390
	4.	.1220 (.0408)	.2252 (.4908)	.1583 (.3058)			.0334
	5.	.1170 (.0570)	.2408 (.5243)	.1679 (.3264)	.0020 (.0156)		.0348
	6.	.1286 (.0515)	.1814 (.4713)	-.3374 (.3887)	.0152 (.0155)	2.577 (1.304)	.2878

ii Moderate Inflation Countries

Referring to Table 10, the constant term is significant and in the complete model, it is about 0.13. The average ratio of fixed investment to output for this category of countries is 0.18, indicating a large proportion of autonomous investment. The output variable in the complete model is not significant. However, it is positive and greater than its standard error, indicating that the rate of change of output may affect investment decision positively. The rate of money supply variable does not have any effect on fixed investment. The effect of inflation is also negligible; its positive sign indicates that price increase may encourage fixed investment. The price expectation variable is not significant and in the complete model, its sign suggests a positive relationship with fixed investment.

iii High Inflation Countries

Regression is not attempted for high inflation countries as there are too few observations. However, comparing Tables 11 and 12, we can draw some tentative inferences about fixed investment in high inflation countries.

The magnitude of the constant term in both tables are similar, implying that the high inflation countries may have similar constant term. In the complete model it is significant, indicating that autonomous investment

Table 10

Cross-Section: Gross Fixed Investment Function

	Equation	Constant Term	Regression Coefficients of $(\Delta X/X)_{t-1}$	$(\Delta M/X)_{t-1}$	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
Countries With Moderate Inflation	1.	.1466	.3603				.4514
		(.0162)	(.1256)				
	2.	.1338	.3610		.0034		.4746
		(.0264)	(.1296)		(.0054)		
	3.	.1332	.3768		.0037	-.1260	.4757
		(.0282)	(.1818)		(.0061)	(.9453)	
	4.	.1415	.3327	.3247			.4703
		(.0191)	(.1389)	(.5733)			
	5.	.1287	.3335	.3230	.0034		.4933
		(.0290)	(.1441)	(.5948)	(.0056)		
	6.	.1287	.3308	.3264	.0033	.0190	.4933
		(.0311)	(.2127)	(.6632)	(.0065)	(1.0363)	

constitutes an important part of total fixed investment in the high inflation countries. For the output variable, the inclusion of high inflation countries in the complete model increases the magnitude of the coefficient and decreses the standard error. This suggests that the change in demand influences investment decision positively in these countries. The rate of money supply is not significant. It is possible that its effect may be higher and more significant in the high inflation countries since the coefficient in equation (6) of Table 12 has increased. The coefficients of the inflation and price expectation variables are decreased relative to their standard errors when high inflation countries are included. We can infer from this that on average, price increases and price expectation may not encourage investment as much as in the other countries.

Comparing the three categories of countries, we find that autonomous factors play an important role in influencing investment in all the three categories. The rate of change in demand of last period is also important, except in the low inflation countries. The available evidence does not show that money supply, inflation and price expectations are of major consequence in inducing fixed investment. Exception is the effect of price expectation in the low inflation countries indicating that more fixed investment can be expected if prices increase at a faster rate.

Table 11

Cross-Section: Gross Fixed Investment Function

	Equation	Constant Term	Regression Coefficients of $(\Delta X/X)_{t-1}$	$(\Delta M/X)_{t-1}$	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
Countries With Low and Moderate Inflation	1.	.1305 (.0168)	.3530 (.1619)				.1546
	2.	.1162 (.0222)	.3537 (.1620		.0054 (.0055)		.1863
	3.	.1286 (.0220)	.2237 (.1679)		.0032 (.0053)	1.056 (.5467)	.2958
	4.	.1268 (.0179)	.3456 (.1643)	.1517 (.2419)			.1677
	5.	.1103 (.0237)	.3447 (.1638)	.1854 (.2433)	.0060 (.0056)		.2056
	6.	.1289 (.0252)	.2232 (.1727)	.0059 (.2591)	.0031 (.0056)	1.062 (.6185)	.2958

Table 12

Cross-Section: Gross Fixed Investment Function

	Equation	Constant Term	Regression Coefficients of $(\Delta X/X)_{t-1}$	$(\Delta M/X)_{t-1}$	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
All Countries	1.	.1306 (.0128)	.3531 (.1363)				.1571
	2.	.1303 (.0145)	.3541 (.1400)		.00002 (.00055)		.1572
	3.	.1297 (.0149)	.3512 (.1424)		.00016 (.00081)	.0255 (.1076)	.1586
	4.	.1277 (.0134)	.3413 (.1379)	.1614 (.2063)			.1716
	5.	.1263 (.0155)	.3450 (.1412)	.1690 (.2130)	.00011 (.00056)		.1725
	6.	.1259 (.0158)	.3430 (.1437)	.1661 (.2167)	.00020 (.0008)	.0192 (.1086)	.1733

B. Time Series Analysis

The results of each country in the time series analysis are presented in the same form as in the cross-section analysis. The complete model is in equation (6) of each table.

i Low Inflation Countries
Guatemala

The results are presented in Table 13. The constant term is significant in all specifications. In the complete model, it has a value of 0.98. For the period studied, the average value of the total fixed investment is 1.30. As the constant term represents autonomous investment, we can see that autonomous factors play a major role in determining the amount of fixed investment. The change in output of last period does not influence investment decision. Comparing the complete model with the other five specifications, we notice that the demand variable ceases to be significant when money supply is introduced, although its sign indicates a positive relationship with investment. The money supply variable on the other hand is significantly different from zero. This suggests that in the decision of expanding capital stock, money supply overshadows demand in importance.

The effect of price increase, denoted by the coefficients of ΔP_{t-1}, is not significant but is seen

Table 13

Guatemala: Gross Fixed Investment Function For 1950-68

Equation	Constant Term	Regression Coefficients of ΔX_{t-1}	ΔM_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	.9127	.8373				.2574
	(.1873)	(.3672)				
2.	.9897	.7551		-.0448		.2354
	(.2054)	(.3899)		(.0774)		
3.	1.0836	.6384		-.1090	6.865	.2719
	(.2412)	(.4237)		(.1141)	(8.848)	
4.	.8347	.3222	2.561			.5494
	(.1532)	(.3419)	(.8502)			
5.	.8420	.3271	2.516	-.0073		.5499
	(.1692)	(.3568)	(.9498)	(.0585)		
6.	.9771	.1202	2.606	-.0642	-8.430	.5633
	(.1990)	(.3924)	(.9618)	(.0938)	(7.180)	

to be discouraging to investment. It is likely that entrepreneurs regard the slight increase in price not to bring enough profit to make up for the loss of demand due to the increase. The price expectation variable, $\Delta\ddot{P}_{t-1}$, is not significant. However, its coefficient is greater than the standard error and is negative. This shows that when prices increase faster, there is a tendency for investment to decrease. This may be due to the entrepreneurs' expectation that the faster prices increase, the smaller demand would be and thus lesser need for investment.

Panama

In equation (6) of Table 14, the constant term is significant and is about 0.40. The average value of the total fixed investment is 0.80, indicating that autonomous investment is about half of the total amount. This ratio is lower than that of Guatemala, implying a relatively lesser role for autonomous factors. The change in demand in the last period is not significant. A comparison of the complete model and the other five specifications shows that the inclusion of price change and price expectation variables invariably decreases the magnitude of the demand variable. In our model, it suggests that when inflation and the expected rate of inflation is considered, the change in demand is of much less importance. The change in money supply also has no observable effect on investment.

Table 14

Panama: Gross Fixed Investment Function For 1950-68

Equation	Constant Term	Regression Coefficients of ΔX_{t-1}	ΔM_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	.2585	1.737				.7325
	(.0956)	(.2710)				
2.	.2772	1.590		.0795		.7278
	(.1116)	(.3376)		(.0781)		
3.	.3433	1.248		.1926	11.355	.7608
	(.1204)	(.4233)		(.1163)	8.822	
4.	.2784	1.551				.7366
	(.1069)	(.4854)				
5.	.2686	1.439	.7130	.0438		.7510
	(.1085)	(.5066)	(1.031)	(.0506)		
6.	.4032	.6871	1.326	.2167	7.251	.7794
	(.1358)	(.7209)	(1.378)	(.1193)	(9.824)	

The result on inflation is shown to be significant in our model. A change in price influences investment in the same direction. In Panama, it appears that in a long period of price stability, an increase in price, ever so slightly, would encourage entrepreneurs to expand the stock of capital in the expectation of increased profits. The rate of price increase, on the other hand, has little impact although it is positively related to investment.

We shall now compare the results of the cross-section analysis with that of Guatemala and Panama. We find consistent results in the studies with regard to autonomous investment. Autonomous factors in the low inflation countries are of major importance to fixed investment. The change in demand, on the other hand, has no observable effect. The impact of money supply is less uniform in the three cases. It is significant in Guatemala and insignificant in Panama and in the cross-section analysis. The effect of inflation is also inconclusive. Not only the statistical significance differs it also has opposite effects as the sign is different in the three cases. The difference in results can be attributed to how entrepreneurs interpret inflation. The interpretation can be vastly different even for countries that have very stable prices. The price expectation variable found to be significant in the cross-section analysis is insignificant

in both cases in the time series study. However, the available evidence shows that expectation of price increase does not necessarily have uniform influence on investment decision, as shown by the difference in sign.

ii Moderate Inflation Countries
Israel

We shall refer to equation (6) in Table 15. The constant term is significant and is about 11.57. The average value of total fixed investment for the period studied is 17.14. Autonomous investment is the major determinant of total fixed capital formation as it accounts for more than 60% of the total amount. On the other hand, the change in demand is insignificant although the coefficient is greater than its standard error and the sign indicates a positive relationship with investment. The effect of the change in money supply is also not significantly different from zero. so are the effects of inflation and price expectation. However, the positive signs for both suggest that inflation and a faster rate of price increase may serve as incentives for investment.

Taiwan

In Table 16, the complete model shows that autonomous investment is insignificant. So is the effect of the change in demand. Comparing our model

Table 15

Israel: Gross Fixed Investment Function For 1952-68

Equation	Constant Term	Regression Coefficients of ΔX_{t-1}	ΔM_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	11.309 (3.441)	1.098 (.5896)				.2243
2.	10.029 (4.264)	1.035 (.6190)		.3293 (.6092)		.2443
3.	11.594 (4.889)	.8876 (.6665)		.2595 (.6311)	30.254 (42.608)	.2806
4.	11.711 (3.950)	1.038 (.6616)	-3.245 (13.381)			.2284
5.	10.447 (4.728)	.9655 (.6980)	-3.671 (13.863)	.3391 (.6378)		.2496
6.	11.570 (5.201)	.8943 (.7293)	5.433 (15.821)	.2563 (.6714)	30.982 (49.664)	.2807

Table 16

Taiwan: Gross Fixed Investment Function For 1951-68

Equation	Constant Term	Regression Coefficients of X_{t-1}	M_{t-1}	r_{t-1}	P_{t-1}	P_{t-1}	R^2
1.	.0476	1.4518					.5577
	(.0259)	(.3456)					
2.	.0133	1.7053			.0039		.5742
	(.0550)	(.5011)			(.0055)		
3.	-.0146	1.8567			.0087	.3578	.6133
	(.0602)	(.5157)			(.0070)	(.3247)	
4.	.0716	-.0192	2.6117	.0039			.8168
	(.0192)	(.4895)	(.7894)	(.0027)			
5.	.0311	.3308	2.5220	.0046	.0048		.8400
	(.0371)	(.5521)	(.7737)	(.0027)	(.0038)		
6.	.0319	.3280	2.5197	.0047	.0046	-.0111	.8401
	(.0454)	(.5841)	(.8135)	(.0038)	(.0052)	(.3077)	

with the other five equations, we notice that the demand variable ceases to be significant when the financial variables are considered, indicating that the latter substitutes demand in importance in investment decisions. For the financial variables, only the money supply is significant. The rate of interest has the coefficient greater than its standard error and is positive. This is contrary to what we postulate in Chapter 3. Both inflation and price expectation have little effect. Their signs indicate a positive relationship with investment for the former and a negative relationship for the latter.

So far, we are not able to examine if inflation promotes or discourages the efficient use of investment in a particular sector that is important to economic development, for example the manufacturing industry. Now, the availability of data allows us to do so for Taiwan. The estimates of the fixed investment function for the manufacturing sector are given in Table 17.

In the complete model, the constant term is insignificant. Like that in the gross fixed investment case, antonomous factors have no effect on fixed investment in manufacturing. The effects of the demand and the financial variables are also similar to that on the total fixed investment. The demand variable is not significant while the money supply variable is. Comparing equation (6) with the other five equations,

Table 17

Taiwan: Fixed Investment Function For The Manufacturing Sector For 1951-68

Equation	Constant Term	Regression Coefficients of ΔX_{t-1}^{M}	ΔM_{t-1}	Δr_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	.0199 (.0084)	1.4890 (.4739)					.4136
2.	.0265 (.0160)	1.3284 (.5869)			-.00098 (.0020)		.4242
3.	.0227 (.0181)	1.3875 (.6164)			-.00018 (.0026)	.0702 (.1420)	.4357
4.	.0126 (.0062)	-.0278 (.4122)	.9758 (.1997)	.0012 (.0010)			.8161
5.	.0028 (.0109)	.0714 (.4190)	1.0573 (.2119)	.0013 (.0010)	.0014 (.0013)		.8340
6.	.0025 (.0146)	.0758 (.4652)	1.0578 (.2226)	.0012 (.0015)	.0014 (.0019)	.0035 (.1211)	.8340

ΔX_{t-1}^{M}: Change in output in the manufacturing sector at period t-1.

we notice that the demand variable ceases to be significant and the R^2 is substantially improved when the money supply variable is introduced. This shows that the movement in the financial market is of greater importance than the movement in demand.

The rate of interest is again positively related to investment, although the coefficient is not significantly different from zero.

Both the inflation and price expectation variables are not significant but appear to affect fixed investment in manufacturing positively.

We may conclude that in Taiwan, the financial variables, particularly money supply, are of major importance in fixed investment decisions in the aggregate amount and in the manufacturing sector. In contrast, changes in demand are insignificant. Inflation also has no observable effect but is positively related to fixed investment. This shows that inflation would not distort the pattern of investment. The effect of price expectation is negligible. While it may affect manufacturing fixed investment positively, it may discourage fixed investment in the total amount.

A comparison of the findings on Israel and Taiwan shows that the effect of money supply and the importance of autonomous investment are different with respect to the statistical significance, although they

are uniformly positive. However, the results are consistent with respect to the output and, inflation variables in that they are insignificant but positively related to investment. Price expectation is insignificant in both cases but the sign is not uniform. Comparing with the cross-section analysis, we find consistent results for output and inflation. We may infer that in moderate inflation countries, change in output and inflation have no effect on fixed investment although they may affect fixed investment positively. Expectation of price change is also insignificant, but its relationship with fixed investment is uncertain. Finally, autonomous investment is positive and money supply affects fixed investment positively, but their importance to fixed investment is not conclusively evident.

iii High Inflation Countries
Colombia

Referring to equation (6) of Table 18, we find that the constant term is significant and has a value of 0.034. The average value of total fixed investment is 0.069, indicating that autonomous investment accounts for about 50% of the total amount. The change in demand is also a significant factor in influencing fixed investment positively. On the other hand, the money supply variable is insignificant. However, the coefficient is greater than its standard error and is positive, suggesting that it may affect

Table 18

Colombia: Gross Fixed Investment Function For 1950-68

Equation	Constant Term	Regression Coefficients of ΔX_{t-1}	ΔM_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	.0613 (.0078)	.3019 (.3379)				.0505
2.	.0357 (.0081)	.8997 (.2577)		.0022 (.0005)		.6259
3.	.0356 (.0084)	.9408 (.2922)		.0021 (.0006)	-.0142 (.0412)	.6296
4.	.0592 (.0083)	.6077 (.5041)	-.8052 (.9761)			.0945
5.	.0304 (.0076)	.7432 (.3061)	.8801 (.6791)	.0027 (.0005)		.6923
6.	.0336 (.0084)	.7244 (.3354)	.8620 (.6979)	.0024 (.0006)	-.0177 (.0404)	.6747

fixed investment positively. The effect of inflation is significant and induces more fixed investment. The price expectation is not significant but its sign suggests a negative relationship with investment. It seems that although entrepreneurs are attracted by the prospect of inflation, they may prefer a slower rate of increase as they may fear too fast an increase would discourage consumption, resulting in a shrinking market.

Korea

The regression results are presented in Table 19. In the complete model, the constant term is not significant. However, the coefficient is greater than its standard error and is positive, indicating that autonomous factors may affect fixed investment positively. The demand variable is not significantly different from zero. Comparing the six equations, we find that the coefficient of the demand variable is less than its standard error whenever the inflation variable is included. This suggests that when entrepreneurs consider inflation in their investment decision, the importance of past demand is further diminished. The money supply variable is significant; an increase in the money supply would encourage more fixed investment. The rate of interest is insignificant. Its negative sign is consistent with our hypothesis in Chapter 3.

Table 19

Korea: Gross Fixed Investment Function For 1955-68

Equation	Constant Term	Regression Coefficients of ΔX_{t-1}	ΔM_{t-1}	Δr_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	.4110	1.0450					.2306
	(.2517)	(.6035)					
2.	.2718	.5706			.0265		.3573
	(.2641)	(.6819)			(.0199)		
3.	.2353	.1966			.0423	2.1307	.4295
	(.2664)	(.7762)			(.0254)	(2.1175)	
4.	.2731	.4893	3.1440	.0180			.8059
	(.1450)	(.3740)	(.7040)	(.0190)			
5.	.1331	.0905	2.687	-.0071	.0312		.9389
	(.0940)	(.2464)	(.4381)	(.0131)	(.0080)		
6.	.1147	.1165	2.5645	.0087	.0411	1.2808	.9643
	(.0782)	(.2269)	(.3666)	(.0109)	(.0082)	(.6203)	

The importance of the financial variables is reflected in the substantial improvement of the R^2 in the equations in which they are included. The improvement is largely attributed to the inclusion of money supply which is the major explanatory variable in our model. For the inflation and the price expectation variables, they are significant and have positive coefficients. Entrepreneurs are induced by inflation to increase fixed capital stock, particularly when the price increase accelerates.

To explore the effect of inflation on investment pattern, fixed investment in the manufacturing sector is analysed. The results are shown in Table 20.

The constant term in the complete model is insignificant. Different from the total fixed investment case, the coefficient is negative and less than its standard error. For the demand variable, it is not significant, with the coefficient approximately the same as its standard error. For the financial variables, money supply is significant and has positive effect on investment while the rate of interest has no observable effect although the sign suggests a negative relationship with investment in the manufacturing sector. Comparing the six equations, we notice that the R^2 is substantially increased when the financial variables are included. This can be attributed to the inclusion of money supply which is the major determinant of

Table 20

Korea: Fixed Investment Function For The Manufacturing Sector For 1955-68

Equation	Constant Term	Regression Coefficients of $\Delta X_{M,t-1}$	ΔM_{t-1}	Δr_{t-1}	ΔP_{t-1}	$\Delta \ddot{P}_{t-1}$	R^2
1.	.0709 (.0625)	1.7173 (.7443)					.3474
2.	.0461 (.0653)	.9841 (.9760)			.0066 (.0058)		.4296
3.	.0389 (.0673)	1.3461 (.2640)			.0119 (.0089)	.5241 (.6586)	.4714
4.	.0279 (.0362)	1.3881 (.5165)	.6845 (.1836)	-.00043 (.0055)			.8353
5.	-.0031 (.0253)	.7407 (.3871)	.6035 (.1224)	-.00457 (.0038)	.0078 (.0023)		.9384
6.	-.0038 (.0270)	.5790 (.5558)	.6004 (.1304)	-.0043 (.0041)	.0089 (.0035)	.1147 (.2648)	.9403

$\Delta X_{M,t-1}$: Change in output in the manufacturing sector at period t-1

fixed investment for manufacturing.

In the complete model, as in the total fixed investment case, inflation has significant effect. The higher the rates of inflation, the more fixed investment would be induced. The price expectation is insignificant but is positively related to fixed investment. Entrepreneurs would be induced to increase fixed capital stock for manufacturing when prices increase, particularly when they increase faster.

The results on Korea show that demand does not play a significant role in fixed investment decisions, in the manufacturing industry or in the aggregate amount. Instead, money supply is influential and is the major determinant. While price expectation has effect on total fixed investment only, inflation clearly influences total investment as well as investment for manufacturing. In so far as developing the manufacturing sector is essential to economic development, the evidence shows that inflation helps to increase fixed investment in this sector and thus improve the productive capacity of the economy.

Comparing the results on Korea, Columbia and the cross-section analysis, we observe that for the high inflation countries there is no uniformity regarding the statistical significance of the explanatory variables and the constant term. However, the signs of the output, money supply and inflation variables indicate

that they tend to affect fixed investment positively. The results on the manufacturing sector of Korea shows that inflation helps to improve, rather than to distort the allocation of investment.

C. Conclusion

One recurring characteristics of the above analysis is the relative importance of the constant term. This shows the importance of autonomous factors in influencing fixed investment, particularly in the low inflation countries.

In the low and moderate inflation countries, the change in demand has no impact on investment. In the high and moderate inflation countries, the evidence shows that inflation may benefit the economy of these countries by increasing fixed investment. In Korea and Taiwan where positive relationship is found between inflation and investment in the manufacturing sector, we may infer that inflation helps to channel fixed investment to its efficient use. This effect of inflation is consistent with the results of Lim's study on Korea,[1] which show that inflation induces more investment in the total amount and in the manufacturing sector. The study by Dorrance[2], although less

[1]Youngil Lim, op. cit.

[2]Graeme Dorrance, op. cit.

conclusive, shows that inflation and growth are positively related for the moderate inflation countries. However, whereas a positive relationship may be established between inflation and investment, no conclusion can be reached regarding the significance of the inflation effect.

There is no uniform effect on investment for the explanatory variables for each category of countries with the exceptions mentioned above. In Chapter 1, we mentioned the difference in opinion about the effect of inflation on investment. The results in this chapter favour the argument that inflation is beneficial. More importantly, however, the same results raises doubt as to the meaningfulness of such a debate since the inflation effect is not always significant anyway. It seems that similar inflation experience does not necessarily generate similar pattern and magnitude of investment.

A comparison of the results on consumption and investment reveals that countries which have negative relationship between consumption and inflation, invariably have positive relationship between inflation and investment. This observation reinforces the idea of forced savings which may be used as funds for investment. In this way, inflation helps to increase national savings and investment.

Chapter 7

SUMMARY AND CONCLUSIONS

In the foregoing chapters, we have attempted to investigate the impact of inflation on both consumption and investment which are considered the two major conponents of output and thus economic growth. A consumption function and an investment function are developed. Both functions are estimated using cross-section and time series data. In each approach, countries are grouped into three categories according to their rates of inflation. The three categories are: low, moderate and high inflation countries. Each category is studied separately.

For the consumption study, both the cross-section and the time series approaches show that income is the chief explanatory variable of consumption expenditures. The relative changes of autonomous consumption, money supply and prices are in general not significantly different from zero. No consistent results are obtained on these variables for countries with low and moderate inflation. For high inflation countries, however, the evidence shows that the rate of savings tends to increase faster. These countries can meet a target level of savings faster than countries

with lower inflation. Although the inflation effect is not significant, it appears to create forced savings in the high inflation countries.

The statistical findings on the investment demand show that autonomous investment is of particular importance in the low inflation countries. It represents a relatively large proportion of total fixed investment. The change in demand and the change in money supply variables are not always significant and effective in investment decisions. Inflation and price expectation also have negligible effects. Like consumption, there is little uniform results within each category of inflation. In countries with high and moderate inflation, however, fixed investment demand appears to be favorably affected by price increase, but the effect is not consistently significant.

The inconclusive results suggest that we are not justified in claiming that certain levels of inflation would generate a fixed pattern of results. They appear to differ with different countries. To explain a pattern of consumption and investment demand, we have to seek explanation other than inflation. Exceptions may be found in the high inflation countries where the rate of savings is faster and where price increase may create forced savings and encourages fixed investment. Even here, we must add a note of caution since the price effect is often not statistically

significant.

Thus, we cannot determine what level of inflation is beneficial to investment or savings in all countries. It has to be determined separately for each individual country. There is, however, evidence that countries with forced savings evidently have favorable price effect on fixed investment. Again, we have to have reservation since the price effects are not always significant.

The results also suggest two points on economic policy. For most of the countries surveyed, either one or both the demand and money supply variables affect investment decision. For consumption expenditures, only the income variable is of major importance. We can see that to change aggregate demand, instituting a policy to change output and income still remains the most effective tool. However, monetary policy can also be effective, although it may be weaker.

The second point concerns the price policy. In view of the overall insignificance of the price variable, the inflation tax policy often advocated is of little effect in getting more savings in the underdeveloped countries. In general, a policy to sustain inflation is no more valuable to attract investment either. Conversely, there may be some reduction of investment under a policy of strict price stability, but the effect is too small to be of any consequence.

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APPENDIX

The data given in the appendix is obtained from the following three sources: United Nations Statistical Yearbook and Yearbook of National Accounts Statistics and International Monetary Fund International Financial Statistics, various issues.

Explanation of the symbols used is given below:

C Private consumption

I Gross fixed capital formation

I^M Fixed capital formation in the manufacturing sector

M Money supply

P Consumer price index with 1963 prices = 100

r Rate of interest

X Gross Domestic Product

X^M Output of the manufacturing sector

Y National Income

Table 21

Cross-Section Data

In millions of national currency

Country	I		C		X	
	1965	1964	1965	1963	1964	1965
Argentina[1]	5.69	16.57	22.50	17.42	23.74	32.93
Bolivia	1051	5022	5667	5736	6463	7310
Brazil	5404	15596	24886	11929	23055	36818
Ceylon	1043	5755	5881	7382	7793	8084
Chile	2859	9376	12563	8410	12743	17956
Colombia[1]	9.50	41.47	45.48	43.50	53.80	60.80
Costa Rica	897	2616	2696	3464	3600	3950
Dominican Republic	89.2	809.6	710.9	1005.6	1102.5	953.1
Ecudor[1]	2.40	14.21	15.09	17.44	19.41	20.76
El Salvador	296	1453	1560	1694	1867	1992
Ghana	271			1208	1357	1608
Guatemala	174	1077	1090	1263	1294	1332
Guyana	70.0	223.8	240.5	303.0	336.5	365.5
Honduras	146	728	788	872	940	1047

Table 21 (continued)

In millions of national currency

Country	I	C		X		
	1965	1964	1965	1963	1964	1965
Iran[1]	77.4	302.8	327.6	405.0	442.6	503.6
Israel	2934	6086	7137	7906	9182	10958
Ivory Coast[1]	43.6	146.0	151.3	204.6	237.1	236.8
Jamaica	124.2	445.6	468.8	557.4	605.0	656.0
Korea[1]	117.6	586.0	699.1	484.6	691.5	798.2
Libya	140.8	174.7	206.3	244.5	398.6	530.1
Malaysia	1064	5131	5446	7684	8187	9050
Malta	9.2	33.5	34.6	48.2	49.2	52.7
Mexico[1]	39.0	176.7	189.5	194.8	228.0	246.6
Morocco[1]	1.44	9.23	9.73	11.86	12.49	13.1
Nicaragua	755			3293	3636	4211
Niger[1]	7.88			66.0	66.4	74.1
Nigeria	234			1488	1567	1648
Pakistan[1]	8.32	35.49	39.03	41.01	44.16	48.6
Panama	100.1	448.1	484.9	559.5	600.8	659.9

Table 21 (continued

In millions of national currency

Country	I	C			X	
	1965	1964	1965	1963	1964	1965
Paraguay[1]	7.90	42.58	43.88	48.36	51.07	55.57
Peru[1]	19.21	66.45	82.56	80.52	96.74	114.90
Philippines[1]	4.21	15.52	16.58	19.05	21.20	23.00
Siena Leone	38.9	204.0	208.1	216.2	245.2	260.8
Sudan	54.5	369.9	381.8	458.0	465.1	488.4
Taiwan[1]	19.09	65.68	71.74	87.28	102.37	113.20
Tanzania	738	3666	3696	4860	5130	5120
Thailand[1]	19.16	52.60	55.99	69.13	74.90	82.80
Trinidad	325.6	739.5	813.0	1144.6	1195.8	1250.6
Tunisia		307.4	349.1			
Uruguay[1]	5.55	24.37	36.43	22.30	32.54	52.36
Venezuela[1]	6.97	19.47	21.60	30.66	35.61	37.61

Table 21 (continued)

In millions of national currency

Country	Y		M			P		
	1964	1965	1963	1964	1965	1962	1964	1965
Argentina[1]	23.60	32.79	4.46	6.38	8.33	79.4	122.1	157.1
Bolivia	5672	6193	702	853	1070	100.7	110.1	113.3
Brazil	18931	29754	2898	5363	9369	58	182	278
Ceylon	6804	6942	1952	2119	2252	97.7	103.1	103.4
Chile	10128	14118	1206	1849	2864	69	146	188
Colombia[1]	45.40	51.00	8.52	10.22	12.20	75.8	117.6	121.8
Costa Rica	2998	3253	683.1	733.8	782.3	97.1	103.2	102.6
Dominican Republic	885.0	799.4	157.5	147.4	170.3	92.1	102.1	100.2
Ecudor[1]	16.08	17.50	3.00	3.27	3.48	94.5	103.4	106.7
El Salvador	1611	1707	387.6	435.2	456.2	98.5	101.6	102.2
Ghana			215.0	294.9	300.5	97.1	112.2	140.8
Guatemala	1133	1153	180.6	207.6	222.7	95.6	99.8	99.0
Guyana	256.5	282.2	84.1	95.6	101.6	99.9	100.4	103.0
Honduras	807	894	113.8	129.2	151.4	97.7	104.5	107.9

Table 21 (continued)

In millions of national currency

Country	Y		M			P		
	1964	1965	1963	1964	1965	1962	1964	1965
Iran[1]	360.5	406.5	74.0	88.2	109.9	99.6	103.9	106.0
Israel	6971	8436	2735	2702	3096	93.8	105.2	113.3
Ivory Coast[1]	179.6	181.4	36.58	59.56	48.93	97	104	108
Jamaica	489.4	530.0	141.2	159.2	168.0	98.3	102.0	104.8
Korea[1]	627.0	713.1	64.76	63.63	97.11	83.6	127.9	145.3
Libya	271.4	383.9	50.49	64.39	97.82	99.6	103.9	109.9
Malaysia	5683	6195	2036	2202	2429	97.0	99.6	99.6
Malta	459	487	7.00	7.28	7.70	98	102	104
Mexico[1]	203.2	219.2	31.53	37.26	40.09	99.4	102.0	105.9
Morocco[1]	11.18	11.81	3.72	3.78	4.09	94.5	104.0	107.6
Nicaragua			450.0	548.8	672.5	99.2	104.6	107.6
Niger[1]			5.88	5.74	6.72	98	104	115
Nigeria			183.2	217.7	236.5	102.8	101.1	105.1
Pakistan[1]	38.42	42.46	8.88	10.78	10.06	100.2	103.2	109.4
Panama	501.8	539.1	110.7	104.8	124.7	99.5	102.4	102.9

Table 21 (continued)

In millions of national currency

Country	Y		M			P		
	1964	1965	1963	1964	1965	1962	1964	1965
Paraguay[1]	44.90	48.60	4.93	6.23	7.28	97.9	101.4	105.2
Peru[1]	81.18	95.81	17.83	21.48	25.40	94.0	110.5	129.2
Philippines[1]	16.51	17.80	4.72	4.86	5.14	94.7	108.2	111.0
Sierra Leone	203.9	214.2	26.66	27.84	28.97	99.2	111.5	116.6
Sudan	413.0	430.0	64.36	67.04	72.24	95.5	103.9	101.4
Taiwan[1]	84.56	91.56	22.67	29.26	33.47	97.9	99.8	99.8
Tanzania	4517	4551	211	179	236	103	102	108
Thailand[1]	53.40	60.60	17.76	20.07	22.89	99.1	102.9	106.7
Trinidad	901.1	976.8	262.0	250.8	261.0	96.3	100.8	102.6
Tunisia	358.0	405.6	144.4	149.7	161.8	97.4	104.2	111.1
Uruguay[1]	28.24	46.44	7.83	10.88	18.55	82	141	221
Venezuela[1]	27.24	28.77	6.08	6.97	7.72	98.9	102.1	103.9

[1]In billions of national currency.

Table 22

Columbia: Time Series Data[1]

Year	I	C	X	Y	M	P
1950	1.11	6.09	7.86	6.84	1.11	35.3
1951	1.19	7.04	8.94	7.66	1.31	38.5
1952	1.33	7.58	9.65	8.28	1.52	37.6
1953	1.79	8.35	10.73	9.21	1.76	43.9
1954	2.16	9.81	12.76	10.94	2.22	47.7
1955	2.38	10.11	13.25	11.25	2.41	43.5
1956	2.53	10.90	14.86	12.66	3.22	46.3
1957	2.64	12.80	17.81	14.80	3.35	53.3
1958	3.34	15.15	20.68	16.46	3.91	61.1
1959	3.91	17.02	23.47	19.08	4.40	65.5
1960	4.83	19.81	26.42	21.82	4.83	68.0
1961	5.54	22.27	30.07	25.14	5.97	74.0
1962	6.13	25.09	33.58	28.23	7.38	75.8
1963	7.17	33.02	43.50	36.40	8.52	100.0
1964	8.65	41.47	53.80	45.40	10.22	117.6
1965	9.50	45.48	60.80	51.00	12.20	121.8
1966	12.30	55.84	73.61	60.00	13.66	146.0
1967	14.73	62.04	83.52	68.80	16.14	157.9
1968	18.82	70.94	96.40	78.60	19.31	167.1

[1]In millions of Pesos.

Table 23

Guatemala: Time Series Data[1]

Year	I	C	X	Y	M	P
1950	67	547	645	578	65.7	90.3
1951	72	578	687	611	67.9	94.0
1952	63	572	689	606	70.3	92.1
1953	60	619	738	644	83.2	94.8
1954	60	666	784	682	84.3	97.4
1955	80	669	813	710	95.5	99.1
1956	134	719	901	790	118.7	100.0
1957	150	755	940	822	138.6	98.9
1958	137	808	971	845	131.9	100.0
1959	113	827	992	868	137.8	99.5
1960	103	852	1021	889	142.6	98.3
1961	109	862	1043	909	153.4	97.8
1962	106	985	1144	1012	155.4	99.9
1963	125	1067	1263	1116	180.6	100.0
1964	159	1077	1294	1133	207.6	99.8
1965	174	1090	1332	1153	222.7	99.0
1966	167	1140	1394	1211	251.3	99.6
1967	192	1187	1453	1254	273.1	100.1
1968	221	1253	1566	1343	292.1	102.0

[1]In billions of Quetzales.

Table 24

Israel: Time Series Data[1]

Year	I	C	X	Y	M	P
1952	322	791	1091	827	282	43.4
1953	368	1024	1379	1078	333	55.6
1954	472	1326	1818	1397	438	62.5
1955	629	1578	2224	1695	551	66.1
1956	689	1872	2661	2026	669	70.4
1957	851	2160	3112	2350	750	74.9
1958	915	2466	3580	2717	897	77.5
1959	1020	2772	4117	3086	1093	78.5
1960	1116	3101	4590	3418	1377	80.3
1961	1453	3654	5534	4030	1618	85.7
1962	1933	4408	6606	4793	2260	93.8
1963	2204	5245	7906	6005	2735	100.0
1964	2750	6086	9182	6971	2702	105.2
1965	2934	7137	10958	8436	3096	113.3
1966	2488	7908	11970	9258	3504	122.3
1967	1988	8113	12331	9640	4975	124.3
1968	2879	9245	14542	11383	6315	126.9

[1]In millions of Israel Pounds.

Table 25

Korea: Time Series Data[1]

Year	I	I^M	C	X	X^M	Y	M	r	P
1955	11.7	2.66	100.3	114.7	10.89	106.1	10.42	6.57	43.6
1956	15.7	3.97	140.6	151.0	14.16	139.8	14.17	6.57	53.6
1957	21.0	4.66	165.5	196.4	17.68	179.7	17.16	6.57	66.1
1958	20.8	4.93	170.8	205.8	20.77	184.9	21.88	7.30	63.7
1959	24.1	4.80	181.5	219.5	24.61	193.4	26.92	10.22	65.7
1960	26.5	5.31	207.3	244.9	27.27	215.9	27.53	10.22	72.4
1961	34.3	7.03	245.4	294.0	34.30	264.6	41.19	10.22	78.3
1962	48.6	10.01	293.8	345.4	40.40	303.3	51.52	10.22	83.6
1963	68.0	15.17	399.6	484.6	61.87	431.6	54.76	10.50	100.0
1964	80.5	19.23	586.0	691.5	97.56	627.0	63.63	28.00	127.9
1965	117.6	30.46	699.1	798.2	129.01	713.1	97.11	28.00	145.3
1966	205.9	64.94	805.9	1018.7	161.52	902.0	157.03	28.00	162.9
1967	264.0	68.60	973.6	1220.4	194.30	1069.9	252.85	23.00	180.5
1968	402.4	95.50	1191.8	1545.5	252.00	1328.7	412.33	23.00	200.6

[1]In billions of Won.

Table 26

Panama: Time Series Data[1]

Year	I	C	X	Y	M	P
1950	28.5	196.0	255.9	207.4	42.2	95.5
1951	26.7	212.9	266.8	216.8	42.4	99.3
1952	29.0	231.8	289.1	239.2	44.3	100.4
1953	35.1	234.7	302.8	250.0	48.5	99.2
1954	35.6	241.6	312.0	252.2	51.1	98.7
1955	33.4	254.6	331.0	269.7	51.4	98.6
1956	47.2	263.0	344.3	281.1	56.4	98.2
1957	55.9	301.4	380.0	311.6	61.4	98.3
1958	52.1	308.0	382.6	322.3	65.2	98.0
1959	54.8	322.3	402.7	338.7	68.7	98.1
1960	61.4	322.9	415.8	336.5	70.3	98.2
1961	80.4	343.3	463.7	378.1	75.5	98.8
1962	85.4	360.8	504.8	411.4	86.9	99.5
1963	96.6	407.3	559.5	462.3	110.7	100.0
1964	87.8	448.1	600.8	501.8	104.8	102.4
1965	100.1	484.9	659.9	539.0	124.7	102.9
1966	142.1	492.9	719.0	589.0	149.1	103.1
1967	152.7	536.2	800.7	650.1	180.7	104.5
1968	173.5	551.8	861.4	695.7	205.4	106.2

[1]In millions of Balboas.

Table 27

Taiwan: Time Series Data[1]

Year	I	I^M	C	X	X^M	Y	M	r	P
1951	1.31	.25	7.1	10.82	1.79	10.9	.94	41.4	30.3
1952	2.02	.34	10.4	15.75	2.11	15.0	1.80	36.0	39.2
1953	2.54	.54	17.5	21.20	2.75	19.5	2.37	21.6	46.3
1954	2.74	.49	20.1	23.15	3.42	20.8	3.01	21.6	47.1
1955	3.49	.81	21.8	27.89	3.70	24.5	3.39	18.0	51.7
1956	4.01	.97	23.2	32.30	5.10	26.0	4.30	18.0	59.4
1957	5.04	1.30	27.0	38.05	6.30	30.0	5.25	14.4	66.0
1958	6.76	1.60	31.4	44.46	6.50	35.9	7.70	18.0	67.7
1959	8.60	1.80	33.4	51.75	8.10	41.6	9.03	18.0	74.8
1960	10.36	2.40	43.3	62.57	9.50	50.8	10.83	16.2	88.7
1961	11.35	2.60	47.9	69.87	10.70	57.0	15.09	15.8	95.6
1962	11.48	2.50	52.1	76.60	11.60	61.5	17.50	14.0	97.9
1963	13.34	2.90	56.9	87.28	15.40	70.6	22.67	14.0	100.0
1964	14.87	4.60	65.7	102.37	19.30	84.6	29.26	14.0	99.8
1965	19.09	5.70	71.7	113.20	20.60	91.6	33.47	14.0	99.8
1966	23.97	7.20	76.8	125.88	23.10	102.0	41.58	14.0	101.8
1967	30.18	10.10	86.1	143.26	27.00	115.2	51.67	14.0	105.2
1968	37.13	12.50	100.0	168.43	32.80	133.2	58.10	14.0	111.8

[1]In billions of NT Dollars.

Thesis

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INFLATION AND ECONOMIC DEVELOPMENT

Edmund K. Mak Fall 1972

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